SPECIFICATION NO. 180

DUCTILE IRON PIPE

180.01 DESCRIPTION

The work specified under this section includes furnishing all labor, tools, equipment, materials, and supplies for the installation of Ductile Iron Pipe for Water Lines or Sanitary Sewers.

180.02 MATERIALS

The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A746	Standard Specifications for Ductile Iron Gravity Sewer Pipe (Latest Revision)

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104	Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water (Latest Edition)
AWWA C105	Polyethylene Encasement for Ductile Iron Pipe Systems (Latest Edition)
AWWA C111	Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings (Latest Edition)
AWWA C115	Flanged Ductile Iron Pipe with Threaded Flanges (Latest Edition)
AWWA C116	Protective Fusion Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service
AWWA C151	Ductile Iron Pipe, Centrifugally Cast, for Water or Other Liquids (Latest Edition)
AWWA C150	Thickness Design of Ductile Iron Pipe (Latest Edition)
AWWA C153	Ductile Iron Compact Fittings, 3 in. through 24 in. and 54 in. through 64 in. for Water Service
AWWA C600	Ductile Iron Water Mains (Latest Edition)

180.02.1 WATER LINES

1. PIPE

   Ductile iron pressure pipe shall conform to the current AWWA C151 (ANSI A21.51) standard. All pipe shall be new, and shall have the AWWA or ASTM designation, pressure class and size of pipe stamped on the outside of each joint. Ductile iron pipe shall be approved by the Underwriter's Laboratory and shall be accepted by the State Fire Insurance Board for use in water distribution systems without penalty. Ductile iron pipe less than six (6") inches in diameter will not be allowed

Ductile iron thickness shall conform in all respects to the current AWWA C150 standard based on a minimum of 200 psi working pressure. A special design shall be provided for large diameters or deep embedments.

Flanged pipe shall conform to AWWA C115 and be based upon a minimum of 200 psi working pressure.

Foreign made pipe shall not be accepted.

2. JOINTS AND GASKETS

All ductile iron pressure pipe shall be furnished with one of the following types of joints, and as described in the Proposal, or shown on the Plans.

Type Joint	Standard
Push-on Joint	AWWA C111
Mechanical Joint	AWWA C111
Flanged Ends	AWWA C115

Flange gaskets shall be full faced and conform to Appendix A of AWWA C115.

3. FITTINGS

Fittings for ductile iron pipe shall be of cast iron, or ductile iron, and shall conform to AWWA C153, unless otherwise specified in the proposal, special specification, or on the plans.

Fitting joints shall be push-on, mechanical, flanged, or special internally locked joint with body thickness and radii of curvature conforming to AWWA C153.

All screwed flanges shall be ductile iron.

4. BOLTS AND NUTS

Bolts and nuts for mechanical joints shall be of a high strength corrosion resistant low alloy steel and conform to AWWA C111. Flange bolts and nuts for above ground installation shall conform to Appendix A of AWWA C115. Flange bolts and nuts for below ground installation shall be 316 stainless steel.

5. POLYETHYLENE ENCASEMENT

Polyethylene encasement of 8 mils thickness shall conform to AWWA C105. Joint tape shall be self sticking PVC or polyethylene, 8 mils thick.

6. RESTRAINT

See Specification No. 120

7. COATINGS

   Pipe exterior to be bituminous coated and in accordance with the requirements of AWWA C151 Section 4.3. Coating and Lining or epoxy coated in accordance with AWWA C116.

8. LINING

   Unless otherwise noted, all pipe shall be cement-mortar lined inside with seal coat all in accordance with AWWA C104 or epoxy coated in accordance with AWWA C116.

180.02.2 GRAVITY SANITARY SEWER LINES

1. PIPE

   a. Ductile iron gravity and pressure pipe shall conform to the current ASTM, A746, and AWWA C111 and C151 (ANSI A21.51) standard. All pipe shall be new, and shall have the AWWA or ASTM designation, pressure class and size of pipe stamped on the outside of each joint. Ductile iron pipe less than eight (8") inches in diameter will not be allowed for sewer mains.

   b. Ductile iron thickness shall conform in all respects to the current AWWA C150/C151 standard, based on a minimum of 200 psi working pressure.

   c. Pipe to be shipped in accordance with the pipe manufacturer's recommendations and stored in a manner that the pipe is not damaged. The Contractor will replace damaged piping at no additional cost to the City.

   d. Flanged pipe shall conform to AWWA C115, and be based upon a minimum of 200 psi working pressure.

2. JOINTS AND GASKETS

   All ductile iron pressure pipe shall be furnished with one of the following types of joints, and as described in the Proposal or shown on the Plans. Flange gaskets shall be full faced, and conform to Appendix A of AWWA C115.

Type Joint	Standard
Push-on Joint	AWWA C111
Mechanical Joint	AWWA C111
Flanged Ends	AWWA C115

   a. All screwed flanges shall be ductile iron.

   b. Gaskets for mechanical and push-on joints to be stored shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.

3. FITTINGS

   a. Fittings for ductile iron pipe shall be of ductile iron, and shall conform to AWWA C153.

   b. Fitting joints shall be mechanical, flanged, or special internally locked joint with body thickness and radii of curvature conforming to AWWA C153.

4. BOLTS AND NUTS

Bolts and nuts for mechanical joints shall be high-strength corrosion resistant low alloy steel, and conform to AWWA C111. Flange bolts and nuts for above ground installation shall conform to Appendix A of AWWA C115. Flange bolts and nuts shall be 316 stainless steel.

Mechanical joint bolts shall be handled and stored in such a manner that will ensure proper use with respect to types and sizes.

5. POLYETHYLENE ENCASEMENT

Polyethylene encasement shall conform to AWWA C105. Joint tape shall be self-sticking PVC or polyethylene, 8 mils thick.

6. COATINGS/ LININGS

All pipe and fittings shall be bituminous or epoxy coated outside and inside, all in accordance with AWWA C104 or AWWA C116. Interior lining for ductile iron sewer pipe shall conform to manufacturer's recommendations. Minimum lining thickness shall be 40 mils, regardless of material recommended.

Other acceptable lining materials are "Protecto 401" Ceramic Epoxy by Vulcan Group or approved equal.

180.02.3 FORCE MAIN

Force mains shall comply with of all requirements of Section 180.02.01 Waterlines.

180.03 SUBMITTALS

A. Submit manufacturer's data on pipe furnished, indicating compliance with the specifications regarding dimensions, thickness, weights, and materials.

B. Submit manufacturer's "Certificate of Compliance," stating that the materials furnished comply with this specification.

180.04 CONSTRUCTION METHODS

A. INSPECTION, STORAGE, AND HANDLING

1. Pipe to be shipped in accordance with the pipe manufacturer's recommendations and stored in a manner that the pipe is not damaged. The Contractor will replace damaged piping at no additional cost to the City.

2. Pipe shall not be stacked higher than manufacturer's recommendations. The bottom tier shall be kept off the ground on timbers, rails, or concrete. Pipe in tiers shall be alternated: bell, plain end; bell, plain end. At least two (2) rows of 4" x 4" timbers shall be placed between tiers and chocks affixed to each end in order to prevent movement.

3. Gaskets for mechanical and push-on joints to be stored shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.

4. Mechanical joint bolts shall be handled and stored in such a manner that will ensure proper use with respect to types and sizes.

B. TRENCH WIDTH

See Spec 130 Trenching for details.

C. PIPE INSTALLATION

All pipe fittings, services, and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the Engineer, who may prescribe corrective repairs or reject the material. All rejected material must be removed from the project immediately at the sole expense of the Contractor.

All lumps, blisters, and excess coating shall be removed from the socket and plain end and the inside of the bell shall be wiped clean and dry and be free from dirt, sand, grit or any foreign material before the pipe is laid.

Foreign material shall be prevented from entering the pipe while it is being placed in the trench. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe.

As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.

At times when pipe laying is not in progress, the open ends of pipe shall be closed by watertight plug, or other means approved by the Engineer. The plug shall remain in place until the trench is pumped completely dry. Care must be taken to prevent pipe flotation should the trench fill with water.

D. JOINT ASSEMBLY

Push-on joints shall be assembled as follows:

Thoroughly clean the groove and bell socket and insert the gasket, making sure that it faces the proper direction and that it is correctly seated.

After cleaning dirt or foreign material from the plain end, apply lubricant in accordance with the pipe manufacturer's recommendations. The lubricant is supplied in sterile cans, and every effort should be made to keep it sterile.

Be sure that the plain end is beveled; square or sharp edges may damage or dislodge the gasket and cause a leak. When pipe is cut in the field, bevel the plain end with a heavy file or grinder to remove all sharp edges. Paint bare surfaces with proper coating. Push the plain end into the bell of the pipe. Keep the joint straight while pushing. Make deflection after the joint is assembled.

Small pipe can be pushed into the bell socket with a long bar. Large pipe requires additional power, such as a jack, lever pull or backhoe. A timber header should be used between the pipe and jack or backhoe bucket to avoid damage to the pipe.

E. MECHANICAL JOINT ASSEMBLY

Wipe clean the socket and plain end. The plain end, socket and gasket should be washed with a soap solution to improve gasket seating.

Place the gland on the plain end, with the lip extension toward the plain end, followed by the gasket, with the narrow edge of the gasket toward the plain end of the pipe.

Insert the pipe into the socket and press the gasket firmly and evenly into the gasket recess. Keep the joint straight during assembly. Make deflection after joint assembly, but before tightening the bolts.

Push the gland toward the bell, and center it around the pipe with the gland lip against the gasket.

Align bolt holes and insert bolts, with bolt heads behind the bell flange, and tighten opposite nuts to keep the gland square with the socket.

Tighten the nuts in accordance with the manufacturer's recommendations.

When it is necessary to deflect pipe from a straight line in either the vertical or horizontal plane, or where long radius curves are permitted, the amount of deflection shall not exceed manufacturer's recommendations.

F. PIPE CUTTING

Cutting pipe for the insertion of valves, fittings, or closure pieces shall be done in a neat, workmanlike manner, without creating damage to the pipe or lining. Seal-coat bare surfaces and cut ends per manufacturer's recommendations.

Cut ends and rough edges shall be ground smooth, and for push-on joint connections, the cut end shall be beveled.

G. POLYETHYLENE TUBE PROTECTION

1. GENERAL

All cast iron & ductile iron pipe and fittings shall be provided with polyethylene tube protection according to the provisions of AWWA C105. Completely cover all fittings and connections with polyethylene film held securely in place with joint tape or strapping. The polyethylene encasement shall prevent contact between the pipe and the surrounding backfill and bedding material.

Where polyethylene-wrapped pipe joints an adjacent pipe that is not wrapped, extend the polyethylene wrap to cover the adjacent pipe for a distance of at least two (2') feet. Secure the end with circumferential turns of tape.

H. EMBEDMENT

Install embedment as shown on the Plans and in accordance with Specification No. 130.

I. REACTION ANCHORAGE AND BLOCKING

The contractor shall install concrete blocking and retaining glands to all unlugged bell and spigot or all-bell tees, Y-branches, bends deflecting eleven and one-fourth degrees (11 ¼°) or more, and plugs which are subject to internal pressure in excess of 10 psi. to preclude separation of joints. See SPECIFICATION NO. 120, CONCRETE BLOCKING OR ANCHORAGE for additional details.

J. MINIMUM COVER

See TECHNICAL SPECIFICATION NO. 600 WATER MAIN CONSTRUCTION or TECHNICAL SPECIFICATION NO. 400 SANITARY SEWAGE SYSTEM for cover requirements.

185.05 TESTING REQUIREMENTS

See: TECHNICAL SPECIFICATION NO. 600 WATER MAIN CONSTRUCTION or TECHNICAL SPECIFICATION NO. 400 SANITARY SEWAGE SYSTEM for testing requirements.

185.06 MEASUREMENT

Payment shall be made at the price bid per unit length per the specification TECHNICAL SPECIFICATION NO. 600 WATER MAIN CONSTRUCTION or TECHNICAL SPECIFICATION NO. 400 SANITARY SEWAGE SYSTEM.